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University of Kentucky

NATURAL INCREASE AND MIGRATION OF KENTUCKY POPULATION: 1920 TO 1935

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Bulletin No. 395

NATURAL INCREASE AND MIGRATION OF KENTUCKY POPULATION: 1920 TO 1935

By MERTON OYLER[1]

Kentucky is in the group of Southern states that have high rates of population increase. In the face of retarded national population growth, the increase and movements of people in rural parts of Kentucky therefore assume not only local but nationwide importance. The central purpose of this study is to measure natural increase and migration, the two component factors of growth or decline, which together account for all changes in the size of any population. Natural increase occurs when more people are born than die. Migration occurs when people move to or from an area. Net migration is the resulting loss or gain.

TRENDS TOWARD NATURAL INCREASE: 1930

Index of Natural Increase. Natural increase is observed in this study by means of an index that can be computed for any population in which the distribution of ages and sexes is known, and for which a normal or maintenance rate of increase has been determined. This index[2] of natural increase is 100 times the number of children under 5 years old per 1,000 women 15 to 44 years old, divided by the corresponding number of children required to maintain[3] the population at its present size without the influence of migration. The index has been computed for the total population and for the urban[4], rural, rural farm, rural non-farm, white and negro populations of each county and of the state.

For any rural population in the state, an index of 100 means that there are just enough (370) children under 5 per 1,000 women aged 15 to 44 to replace persons removed by death, and thus to keep the population at its present size for one generation (28 years) unless migration disturbs the trend. However, in a county

1 A number of the special tabulations of Federal Census data and all except two of the charts used in this study were made by clerical workers assigned to the Department of Farm Economics on a general statistical project of the Federal Works Progress Administration.

2 A further explanation of this index and the reasons for its use are given in the appendix, pages 264 to 266.

3 Computed by the Scripps Foundation for Population Research from unpublished life tables for the white population of Kentucky. Estimates of the replacement ratio (as of 1930) are 370 (rural) and 385 (urban) children under 5 per 1,000 women 15 to 44 years of age.

4 Population classes (urban, rural, etc.) are defined on page 263 of the appendix.

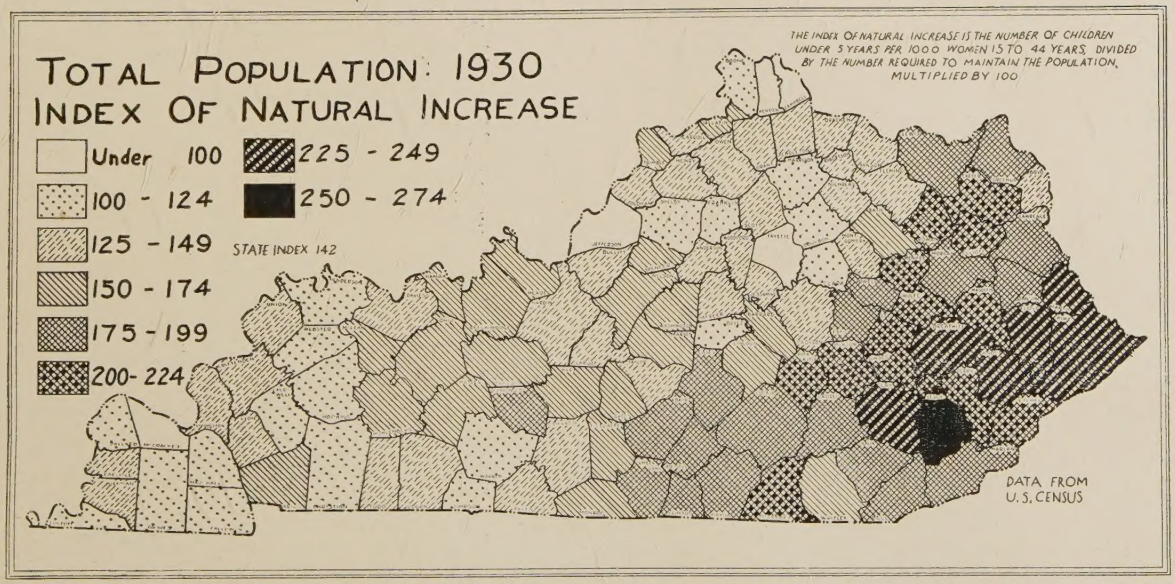
TOTAL POPULATION: 1930
INDEX OF NATURAL INCREASE
Under 100
100 - 124
125 - 149
150 - 174
175 - 199
200- 224
225 - 249
250 - 274
STATE INDEX 142
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
DATA FROM U.S. CENSUS

FIGURE 1. Total population: 1930. Index of natural increase.

for which the index is 150, population will not only maintain its present size but will actually increase by 50 percent at the end of a generation, unless migration should offset this tendency.

NATURAL INCREASE BY COUNTIES, TOTAL POPULATION

The index of natural increase for 1930 is 100 or more in all but five of Kentucky's 120 counties (figure 1). It is below 100 in Jefferson, Fayette, Kenton, Campbell and McCracken Counties, indicating that these populations are not being maintained by natural increase[5] alone. They would decline, were it not for immigration. It will be noted that these counties include the major areas of urban concentration in Kentucky (Louisville, Lexington, Covington, Newport and Paducah).

In contrast to these urban counties stand the rural counties of high natural increase in Eastern Kentucky. Seven of the eastern counties have indexes above 225 and the index for Leslie County is 260 (the highest rate of natural increase for any county in the United States)[6]. In a county that rears 2.6 times the number of children needed for population maintenance, the homes, schools and other social groups or agencies must meet excessive burdens for child care and training. Other communities receive the benefits, however, since Leslie County experienced a net loss of one person in every four during ten years by migration[7].

Assuming the continuation of present trends and ignoring the likelihood of migration, Leslie County population would double by natural increase within 24 years[8], which is less than the length of an average generation. Among the remaining highland counties of Eastern Kentucky there are eight in which population would double in less than 30 years, and 18 more in which it would double within 40 years. If some fantastic wall were to keep people from crossing Kentucky borders, natural increase would double the population of the state in 77 years. Migration[9] is the chief reason why this rapid growth does not occur. Another reason is the continuing decline in the rate of natural increase[10].

---

5 When the index falls below 100, natural increase is really "natural decrease"; or in algebraic terms, a negative increase.

6 National Resources Committee, Population Statistics, 1. National Data, table 15, pages 51 to 59. Washington: U. S. Government Printing Office, 1937.

7 The rates of migration are given in the appendix, table 6.

8 These estimates are based upon geometric rates of accumulation. Periods of time estimated on the basis of arithmetic assumptions would be longer. See table 2, appendix.

9 See page 251.

10 See page 248.

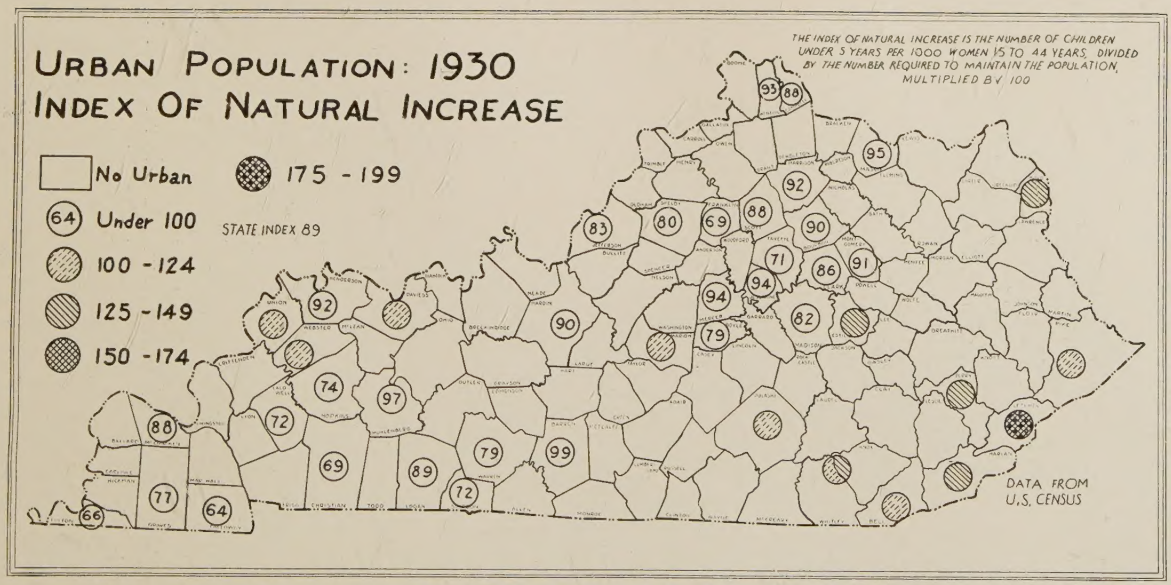
URBAN POPULATION: 1930
INDEX OF NATURAL INCREASE
No Urban
64 Under 100
100 - 124
125 - 149
150 - 174
175 - 199
STATE INDEX 89
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
DATA FROM U.S. CENSUS

FIGURE 2. Urban population: 1930. Index of natural increase.

URBAN AND RURAL RATES OF NATURAL INCREASE COMPARED

Urban population is present in approximately one-third (44) of Kentucky's counties (figure 2). In 14 of these counties, urban population could be maintained by natural increase without the aid of immigration. In the 30 other counties, however, urban population would decline were it not for the movement of people from other areas.

Their failure in self-maintenance is becoming a well-known characteristic of urban populations, and the low index in 30 counties is consistent with nationally observed effects of urbanization[11]. The higher indexes in 14 counties, however, are due to factors offsetting the influence of urban concentration. It will be noted that 10 of the 14 counties[12] having an urban index of greater than 100 are in the Eastern Kentucky coal mining or recently industrialized areas. These populations are composed largely of rural immigrants still exhibiting characteristic rural tendencies toward high natural increase.

Three other counties in which the urban population is maintaining itself (Webster, Union and Daviess) are in the northern edge of the Western Kentucky coal field. They have experienced recent industrial or coal mining development and have drawn population from surrounding areas.

The lowest urban indexes in Kentucky are recorded for Calloway, Franklin, Christian and Fulton Counties. In Calloway, Franklin and Christian Counties, the index is undoubtedly depressed by the fact that unusually low percentages of urban women 15 years of age and over are married[13]. In Fulton County the infant mortality rate during the years 1925 to 1929 was so high that it would lead to a low index of natural increase. The index for Christian County was also affected by a period of high infant mortality[14], reducing the ratio of children to women.

The rural population in every Kentucky County was self maintaining in 1930 (figure 3). There are marked inter-county differences, however. A natural growth of less than 25 percent per gen-

11 Whelpton, P. K. "Geographic and Economic Differentials in Fertility," The *Annals*, November, 1936, page 46, table 4.

12 In Pike, Pulaski, Marion, Daviess, Webster and Union the index was only slightly over 100, and factors depressing the rate of natural increase are undoubtedly at work in these areas.

13 Federal Census of Population, 1930, Vol. III, Kentucky, table 15, pages 929 to 931.

14 Preliminary Vital Statistics, 1925 to 1929 Annual Reports, *Bulletin of the State Board of Health of Kentucky.*

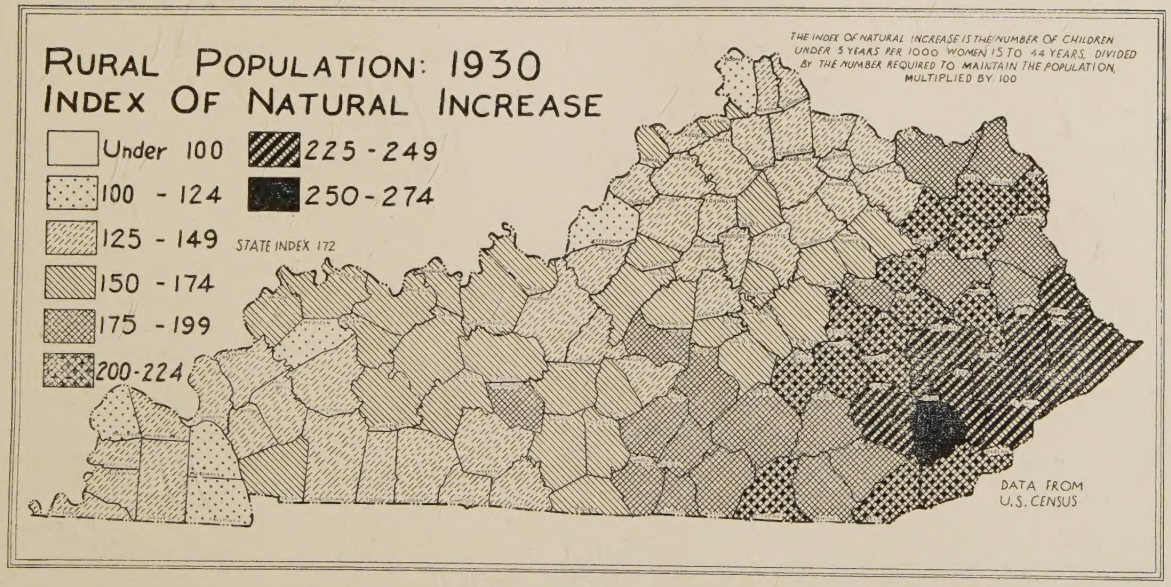
RURAL POPULATION: 1930
INDEX OF NATURAL INCREASE
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
Under 100
100 - 124
125 - 149
150 - 174
175 - 199
200-224
225 - 249
250 - 274
STATE INDEX 172
DATA FROM U.S. CENSUS

FIGURE 3. Rural population: 1930. Index of natural increase.

eration in the rural population is found in only five counties (Ballard, Marshall, Calloway, Webster, Jefferson and Boone). The rate of natural growth is greater than 100 percent per generation in 24 counties, all in the Eastern highland areas. Actually, migration from the area will diminish this tendency toward a massing of rural people in areas already completely settled. These rural tendencies are influenced, in any area, by the proportions of farm and nonfarm dwellers.

RURAL-NONFARM AND RURAL-FARM COMPARISONS

Nationally, it has been observed that the rural-farm population exhibits a higher rate of natural increase than does the rural-nonfarm population[15]. The state figures for Kentucky are in agreement with this general difference (figures 4 and 5). The state-wide rate of natural growth per generation is 67 percent for the rural-nonfarm, and 75 percent for the rural-farm population.

However, there are among the counties several reversals of this relationship. In 24 of the 120 counties[16] rural-nonfarm population has a higher index of natural increase than does the farm population[17]. This is contrary to the usual difference. In half of these 24 counties the rural-nonfarm index is less than 10 points above the rural-farm figure, indicating that both populations tend to increase at similar rates.

Three factors combine to account for the high non-farm indexes of natural increase in the other 12 counties. High proportions of women 15 years of age and over are married, the areas are remote from urban influence, and the major non-agricultural enterprise of the rural-nonfarm people is mining. In only two counties, Christian and Ballard, is the rural-nonfarm population failing to maintain itself.

The rural-farm population of every county showed natural increase in 1930 (figure 5). The farm population of Calloway County increases at the rate of only 11 percent per generation, but in Leslie County the natural increase would lead to a growth of 165 percent per generation. The inter-county variations of rural natural increase (figures 3 and 4) are now seen to be strongly affected by variations in rates of rural-farm increase.

15 Whelpton, op. cit., page 46.
16 See table 4 in the appendix.
17 In 11 additional counties the rural non-farm index is less than 10 points below the rural farm figure.

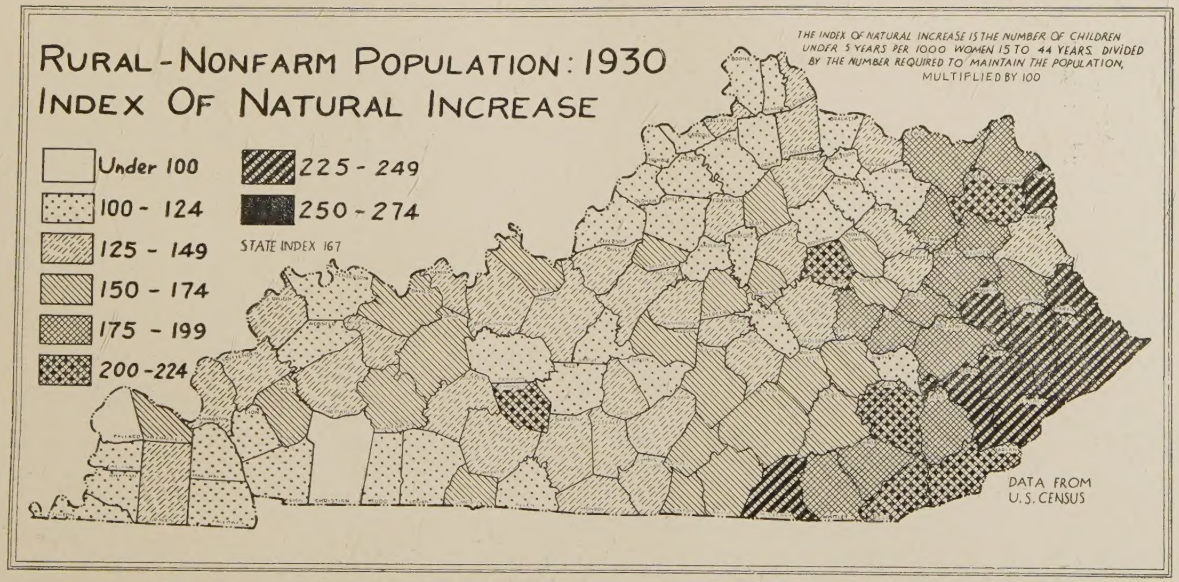
RURAL-NONFARM POPULATION: 1930
INDEX OF NATURAL INCREASE
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
Under 100
100 - 124
125 - 149
150 - 174
175 - 199
200 - 224
225 - 249
250 - 274
STATE INDEX 167
DATA FROM U.S. CENSUS

FIGURE 4. Rural-nonfarm population: 1930. Index of natural increase.

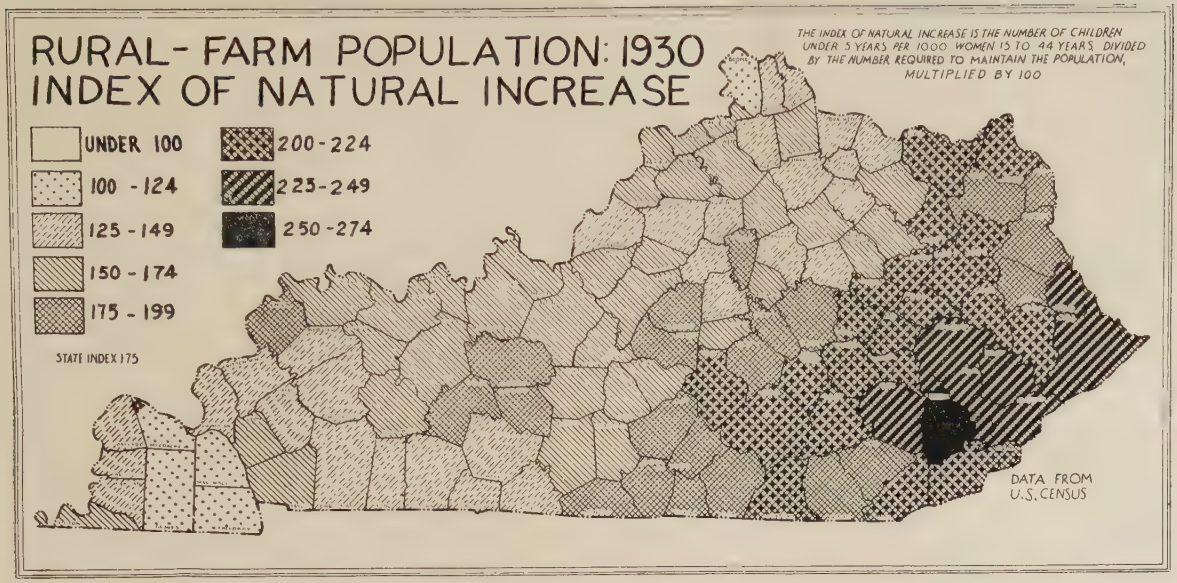
RURAL-FARM POPULATION: 1930
INDEX OF NATURAL INCREASE
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
UNDER 100
100 - 124
125 - 149
150 - 174
175 - 199
200 - 224
225 - 249
250 - 274
STATE INDEX 175
DATA FROM U.S. CENSUS

FIGURE 5. Rural-farm population: 1930. Index of natural increase.

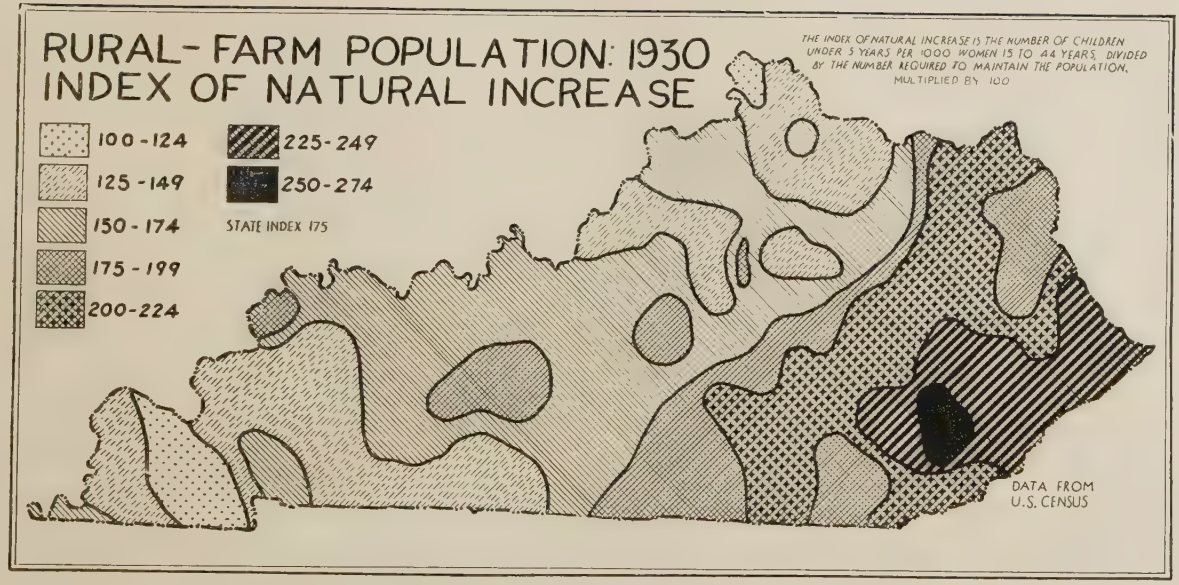
RURAL-FARM POPULATION: 1930
INDEX OF NATURAL INCREASE
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
100-124
125-149
150-174
175-199
200-224
225-249
250-274
STATE INDEX 175
DATA FROM U.S. CENSUS

FIGURE 6. Rural-farm population: 1930. Index of natural increase. (Isometric map.)

Proximity to large cities depresses the rate of natural increase among farm people. This influence is illustrated by the isometric map (figure 6) showing gradations of natural increase as a topographic map would show elevations of the earth's surface[18]. The rural-farm index is particularly depressed in the vicinities of Cincinnati, Louisville, Lexington and Paducah; somewhat less depressed around Ashland and Corbin. Nashville, Tennessee, affects the Southern Christian, Todd and Logan areas. This area of low natural increase among farm people extends northward beyond Madisonville to the Ohio River.

RACE DIFFERENCES IN NATURAL INCREASE

The white population of Kentucky was reproducing itself 46 percent in excess of maintenance needs in 1930 (figure 7). In 10 highland counties of Eastern Kentucky, the white index of natural increase was greater than 225, sufficient to augment present population by 125 percent in a generation, if there were no counter tendency in migration. There are no other areas in the United States that have retained to such a marked extent the rural traits of large population increase, and it is likely that these counties will yield liberally of their sons and daughters to the maintenance of population in other places. If channels of migration for these Kentucky-born young people are not kept open the competition for resources in the area may become excessively keen. The problems of child rearing and youth training prior to the age of migration are particularly acute in these areas.

In contrast, the negro population in Kentucky was increasing in 1930 at only two percent above the maintenance level (figure 8). This is explained by the fact that 52 percent[19] of all negroes in the state reside in urban areas. In two counties (Russell and Spencer), the relatively small negro populations were found to have indexes of natural increase greater than 225. The index of natural increase for negroes has been computed separately for only the 88 counties in which 30 or more negro children under 5 were enumerated. Altho the gradations from high to low rates of natural increase accompany the classifications from rural-farm to urban residence, for the negro as well as the white population, the negro rates for

18 The method used in constructing the isometric map was that presented by Dr. Ernest W. Mowrer. See his article, "The Isometric Map as a Technique of Social Research," *American Journal of Sociology*, Vol. XLIV, pages 86 to 96, July, 1938. See appendix, page 269, for further discussion.

19 Table 1, appendix, page 271.

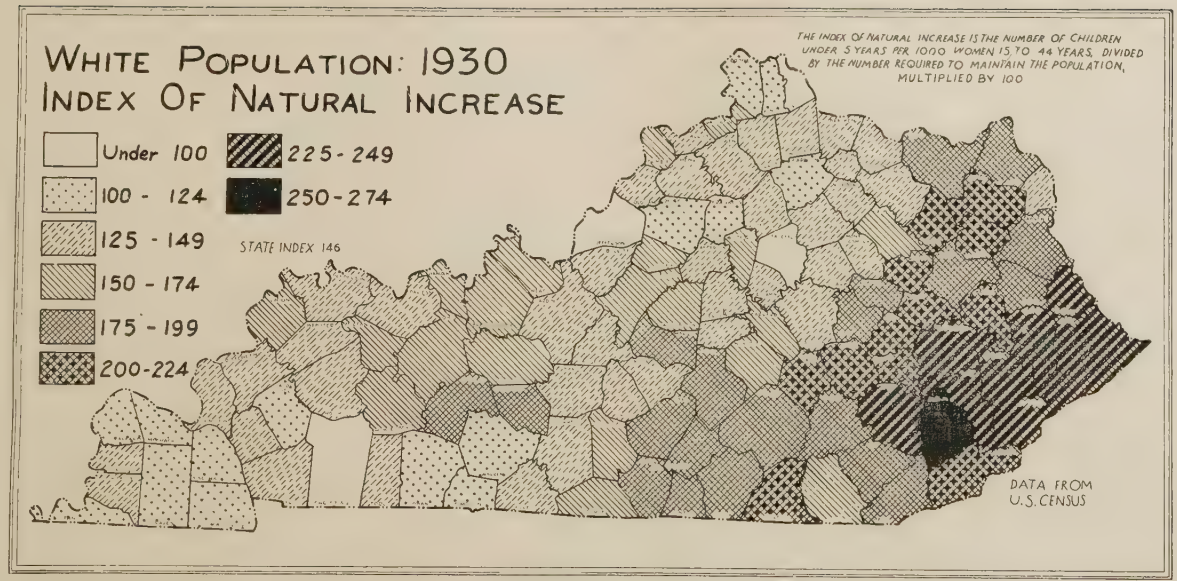
WHITE POPULATION: 1930
INDEX OF NATURAL INCREASE
THE INDEX OF NATURAL INCREASE IS THE NUMBER OF CHILDREN UNDER 5 YEARS PER 1000 WOMEN 15 TO 44 YEARS, DIVIDED BY THE NUMBER REQUIRED TO MAINTAIN THE POPULATION, MULTIPLIED BY 100
Under 100
100 - 124
125 - 149
150 - 174
175 - 199
200-224
225 - 249
250-274
STATE INDEX 146
DATA FROM U.S. CENSUS

FIGURE 7. White population: 1930. Index of natural increase.

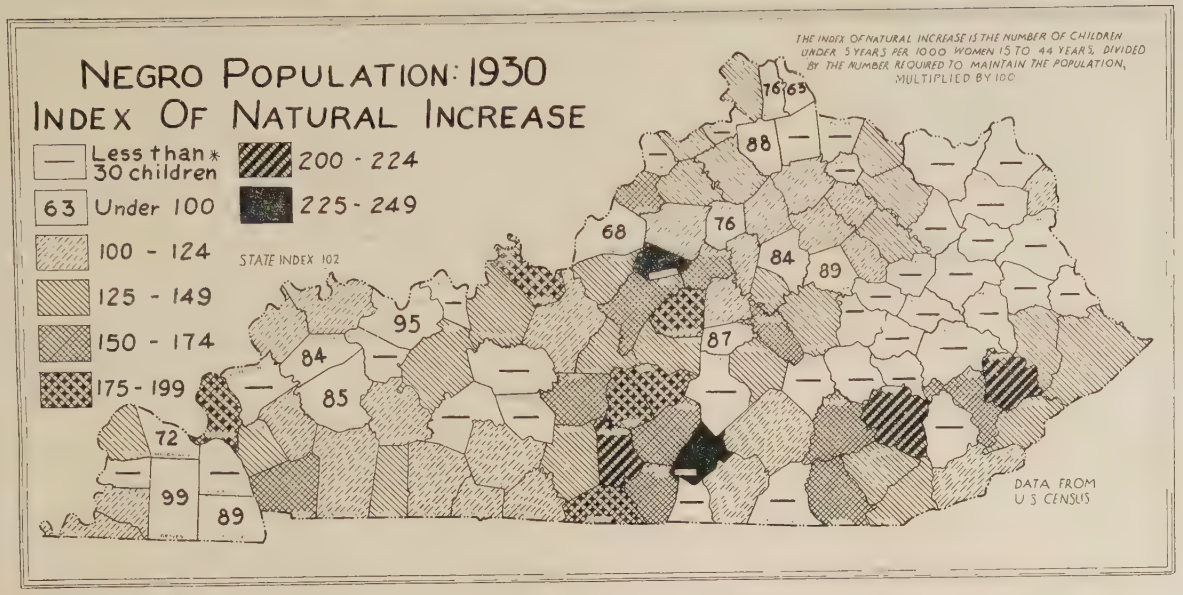

FIGURE 8. Negro population: 1930. Index of natural increase.

all residence classes are markedly lower than white-population rates[20]. The urban index of natural increase for negroes in Kentucky is 22 percentage points lower than the urban index for the white population. Even the rural-farm index is 166 for negroes in contrast with the white-population index of 175.

The state index of 102 is so nearly at the maintenance level that it failed to offset emigration, and resulted in a decline of negro population during the two decades from 1910 to 1930. The adjustment that has been made for under-enumeration of negroes under 5 years of age in 1930 makes this low negro index all the more significant as an indication of slow natural increase trends.

CHANGING RATES OF NATURAL INCREASE

Rates of natural increase were smaller in 1930 than in 1910 for the total urban and rural population of the United States[21]. In most of the Southern states the ratio of children under 5 to women 20 to 44 declined by 20 percent or more[22] between 1910 and 1930. For the population of Kentucky, the index of natural increase declined from 152 in 1920 to 142 in 1930, a drop of 6 percent or 10 points during the decade. Because the index of natural increase is computed from the number of children under 5 years of age, this 1920 to 1930 comparison[23] approximates a comparison of the average birthrate from 1915 to 1919 with that from 1925 to 1929.

Altho the index for the population of the state as a whole declined 6 percent from 1920 to 1930, this change was not uniform in all areas. In 14 counties the 1930 index was actually higher, having been raised by increments ranging from less than one percent for Pendleton and Campbell Counties to nearly 16 percent for Gallatin County. The percent of change in the index of natural increase for 14 Kentucky counties having a higher index in 1930 than in 1920 was:

Urban Counties (containing a city larger than 20,000)		Other Counties			
Jefferson	7.5	Pendleton	0.6	Mason	3.3
Kenton	7.8	Daviess	1.1	Perry	3.5
Fayette	7.5	Boone	1.6	Jessamine	5.3
Campbell	0.9	Woodford	2.4	Oldham	7.4
		Scott	2.8	Gallatin	15.7

20 Ibid.
21 National Resources Committee, Problems of a Changing Population, 1938, table 1, page 127.
22 Ibid, page 125.
23 See discussion of method in appendix, pages 264 to 266.

The increase for Jefferson County (containing Louisville) is not an isolated reversal of the downward trend. Several cities containing 100,000 or more population had an upward trend in the ratio of children under five to women of child-bearing age. These included Chattanooga, Washington, D. C., and several cities in the New England states. In the three Southern cities the increase occurred among both the native white and the negro population[24].

Vital Index. The change in the birth rate both before and after 1930, and for the white and negro population of Kentucky, can be measured by using the vital index, which is the number of births per 100 deaths. The vital index of the total white and negro population of Kentucky, for periods of years, 1920 to 1937, inclusive, was:

Period of years	Vital index*		
	Total population	White population	Negro population
1920 to 1929	**220**	**244**	**92**
1920 to 1924	235	262	97
1925 to 1929	206	228	88
1930 to 1934	196	218	77
1935 to 1937	183	202	68

* Computed from annual reports of Preliminary Vital Statistics, Bulletin of the State Board of Health of Kentucky.

The vital index has declined steadily since 1920, for both the white and negro populations. A low vital index occurs when there are relatively few births or relatively many deaths. Which of these factors accounted for the declining vital index in Kentucky? The average number of deaths per year for the white population increased 15 percent from the five year period beginning with 1920 to the three year period beginning with 1935. If the death rate had remained constant, the vital index in the 1935 to 1937 period would have declined to only 232 instead of to the actual figure of 183. One-half the decline was the result of an increase in the number of registered deaths and one-half, or 15 percent, was the result of a decline in the number of registered births. This represents a decline of about one percent each year.

The number of negro registered deaths increased only three-hundredths of one percent, hence the decline in the vital index was due entirely to a decline in the births. Assuming that registration

24 See National Resources Committee, *Population Statistics*, 1. *National Data*, table 12, pages 30 to 39.

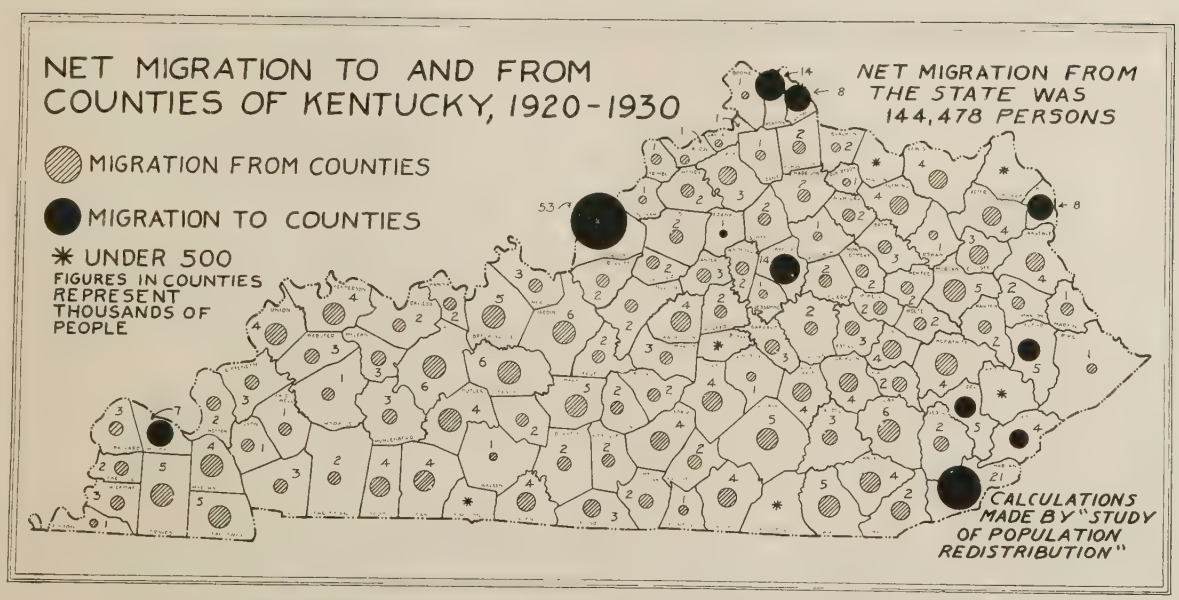
NET MIGRATION TO AND FROM COUNTIES OF KENTUCKY, 1920-1930
MIGRATION FROM COUNTIES
MIGRATION TO COUNTIES
* UNDER 500
FIGURES IN COUNTIES REPRESENT THOUSANDS OF PEOPLE
NET MIGRATION FROM THE STATE WAS 144,478 PERSONS
CALCULATIONS MADE BY "STUDY OF POPULATION REDISTRIBUTION"

FIGURE 9. Net migration to and from counties of Kentucky, 1920-1930. (Thousands of migrants.)

of negro births was 80 percent complete for 1930, in Kentucky, as estimated by Whelpton[25], and that this ratio was similar for each year following 1930, then the estimated negro births, 1930 to 1934, were just about equal to the registered negro deaths in Kentucky for that 5-year period. The death registrations were no doubt somewhat less than complete. With all of these estimates taken into consideration, births were certainly fewer in number than deaths in the negro population of the state, following 1930.

MIGRATION: 1920 TO 1930

The number of people in any area is changed by the occurrence of births, deaths and migration. The effects of birth and death (natural increase) are modified or concealed by the effects of population movement. Births and immigration lead to increase; deaths and emigration lead to decrease. Their differences account for all gains or losses of population. In order to study separately the influence of natural increase it has been discussed as tho unaffected by migration. The study proceeds now to estimates of population movements, referring to consequent gain or loss as "net migration"[26].

NET MIGRATION AND TOTAL POPULATION[27]

During the decade from 1920 to 1930, eleven counties had net migration gains in excess of 500 persons each, ranging from less than a thousand in Franklin County to 53,000 in Jefferson County (figure 9). In five counties the net migration was less than 500 persons — the direction being therefore unimportant because the net amount was insignificant. The other 104 counties had a net migration loss of more than 500 persons each, eleven of them having net losses of more than 5,000 persons each. The sum of all county losses and gains establishes an estimated net loss to Kentucky of 144,478 persons during the decade of the nineteen-twenties.

THE RATIO OF NET MIGRATION TO 1920 POPULATION

If more people leave an area than enter it, the net migration

25. Reference cited in the discussion on method in the appendix, page 265. His corresponding estimate for the completeness of registration of white births in 1930 was 87 percent.

26 The method of measuring net migration is described in the appendix, page 267.

27 Cf. Thornthwaite, C. W., *Internal Migration in the United States*, plate VIII and pages 26 to 28. Philadelphia: The University of Pennsylvania Press. The migration data for total population by counties, as presented in this section and in figure 9, were unpublished calculations furnished the author by Dr. Thornthwaite who made them for the "Study of Population Redistribution," a national organization for special research that was located at the University of Pennsylvania.

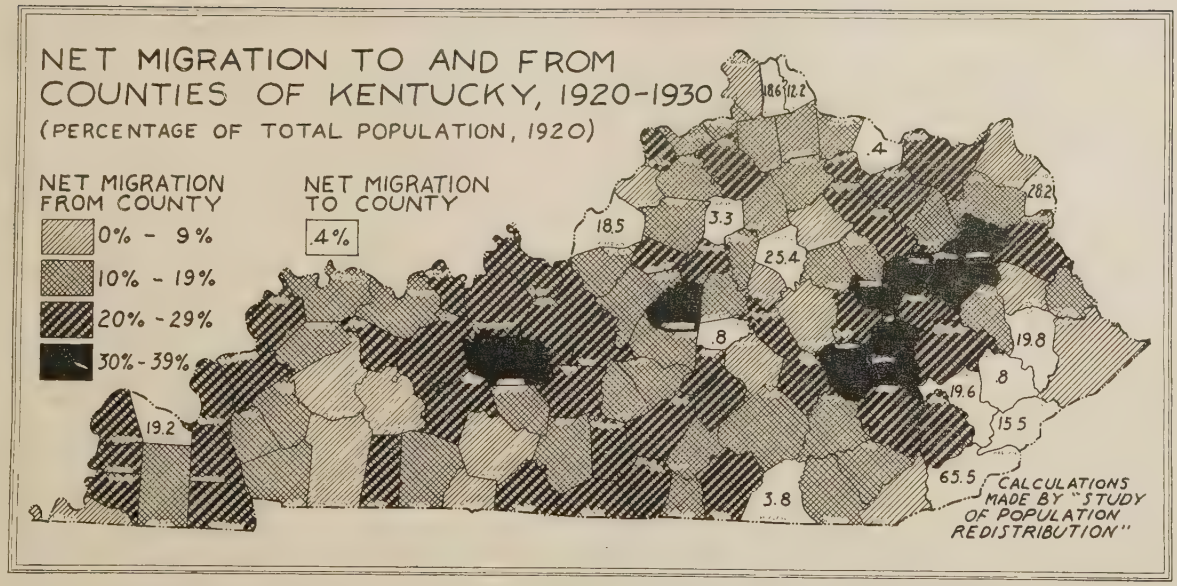

FIGURE 10. Net migration to and from counties of Kentucky, 1920-1930. (Percentage of total population, 1920.)

outward, expressed as a percent of the population at the beginning of the decade, is an indication of the comparative inter-area opportunities for satisfactory living, as judged by the migrants. The nine counties in which net migration losses amounted to 30 percent or more of the 1920 population have accordingly drawn attention[28] as "disadvantaged areas" (figure 10).

These areas include seven contiguous counties in the Eastern Highlands together with Washington and Grayson Counties in the West-Central part of the state. Forty-two additional counties had net migration losses of from 20 to 30 percent during the decade. A net gain by migration was recorded for each of the six counties which contain a city with more than 25,000 population in 1930. Of the six other counties containing a city of above 10,000 population, only one, Franklin County, had a net migration gain. Of the 15 counties which netted a gain by migration, the other 8 included 6 counties which expanded their coal mining operations during the decade. Boyle and Mason, the two remaining counties, had very small net gains by migration.

Among the 16 counties with net migration gains, three had net gains exceeding 25 percent of their 1920 population. Harlan County led with 65.5 percent, which was more than twice the gains made in Boyd and Fayette Counties. The sum of net gains and losses for all the counties indicates a net loss of six percent from Kentucky to other states.

RURAL NET MIGRATION: 1920 TO 1930

The absence of urban population in seventy-six Kentucky counties accounts for general correspondence of migration effects upon total and rural population (figures 10 and 11). In 89 of the 120 counties, net migration losses of rural and total populations were in similar proportion to their respective 1920 enumerated populations[29]. In five counties[30] rural net losses were concealed in total net gains. The total gains were due to the presence of urban centers.

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28 Taylor, Carl C., Wheeler, Helen K. and Kirkpatrick, E. L., *Disadvantaged Classes in American Agriculture*. Social Research Report No. VIII, U. S. D. A., The Farm Security Administration and the Bureau of Agricultural Economics, cooperating, page 76. Washington: Farm Security Administration, 1938.

29 Net rural migration estimates were computed differently from the net total migration estimates. See appendix, page 267. In comparing figures 10 and 11 it should be noted that the bases used for computing percentages are not identical and the maps are accordingly not strictly comparable.

30 Boyd, Boyle, Franklin, Mason, McCracken.

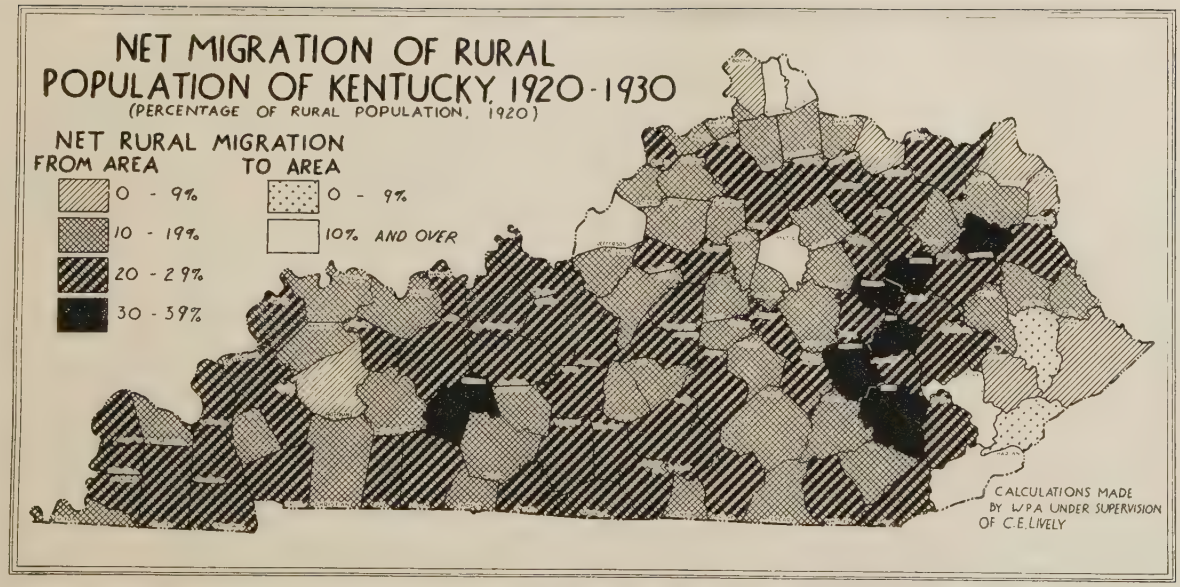

FIGURE 11. Net migration of rural population of Kentucky, 1920-1930. (Percentage of rural population, 1920).

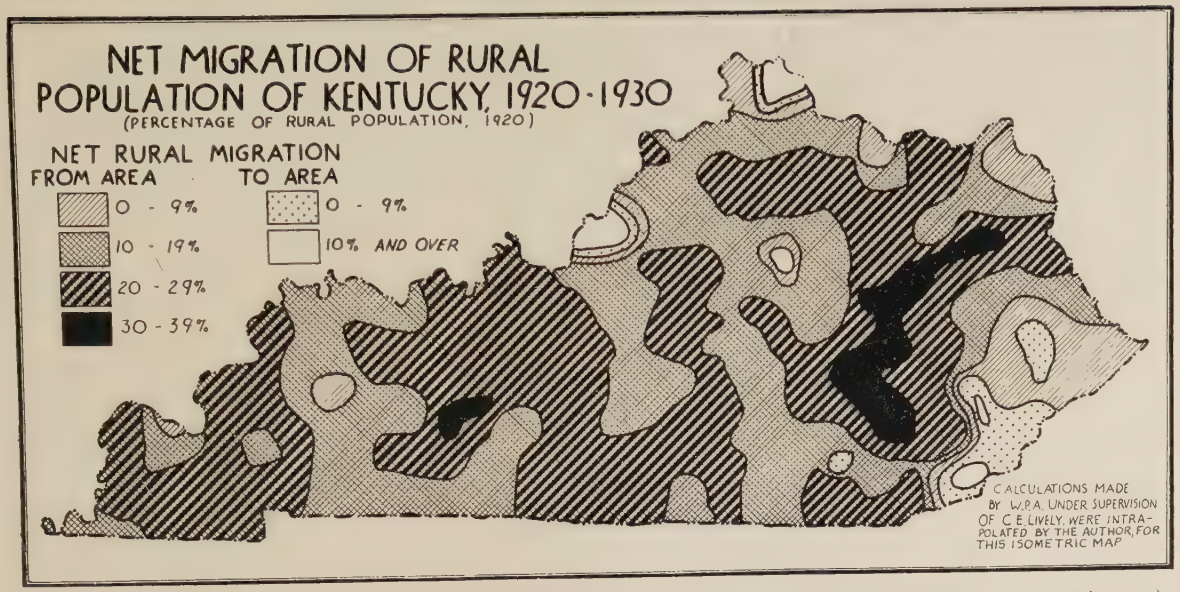
NET MIGRATION OF RURAL POPULATION OF KENTUCKY, 1920-1930
(PERCENTAGE OF RURAL POPULATION, 1920)
NET RURAL MIGRATION
FROM AREA
TO AREA
0 - 9%
10 - 19%
20 - 29%
30 - 39%
0 - 9%
10% AND OVER
CALCULATIONS MADE BY W.P.A. UNDER SUPERVISION OF C.E. LIVELY, WERE INTRAPOLATED BY THE AUTHOR, FOR THIS ISOMETRIC MAP

FIGURE 12. Net migration of rural population of Kentucky, 1920-1930. (Percentage of rural population, 1920. Isometric map.)

Rural net migration gains occurred in only eight counties, suggesting expansion of rural non-farm groups around Louisville, Lexington, Cincinnati and in the Eastern Kentucky coal areas. Interpolation of county figures permits the generalization of county net migration data (figure 12). It is clear from the isometric map that rural net migration gains occurred near cities and coal fields, while the largest rural net emigrations occurred from a tier of Eastern highland counties, least well equipped with resources for urbanization.

Comparison of rural natural increase with rural net migration (figures 6 and 12) indicates marked coincidence of high natural increase and heavy emigration. We also note several areas where loss by migration is higher than the birth rate. These are the Eden Shale Area extending from Owen to Bath Counties, the South Central Belt extending from Spencer to Cumberland and Wayne Counties, the area that centers in Ohio County, and the area which includes most of the Purchase Region. All these areas are faced with problems of agricultural adjustment that are associated with low incomes. Hence the loss by migration points toward some reduction in the intensity of cultivation and an increase in the size of farms in these areas. In a large proportion of these counties the average size of farm has increased since 1920, as reported by the Census.

POPULATION BORN IN KENTUCKY LIVING ELSEWHERE, 1920 AND 1930

The net loss by migration from Kentucky of 144,478 persons as stated in a previous section[31], can be compared with the analysis of data from the Federal Census concerning differences between the state of birth and state of residence[32] of enumerated persons. While the chief emphasis of this study has been placed on population changes among the counties and within urban-rural divisions of Kentucky, this fact of net migration from the state is related very closely to inter-county migration.

During the single decade, 1920 to 1930, Kentucky lost by net migration to other states 123,044 persons, as calculated from these data on state of birth and state of residence. This method results in an under estimate because it does not adjust for the deaths oc-

31 Page 251, supra.
32 Federal Census, 1930: Population, Vol. II, chapter 4, pages 146 to 167.

curring during the decade among those Kentucky natives who were living outside the state. The total is very probably nearer 144,478 persons as reported in figure 9. How does the interstate migration during this decade compare with that cumulated from previous decades and in what general directions has it proceeded?

Native White Migrants. More than eight hundred thousand (857,874) white persons born in Kentucky were living in other states in 1930. At the same time, only about two hundred fifty thousand (253,990) white persons born in other states were living in Kentucky. Hence its contribution to other states has been more than three and one-third times as large as the return.

Prior to 1900, movement from Kentucky was predominantly westward[33], Missouri receiving the largest number of emigrants. After the turn of the century, the direction of emigration veered to the North, and in 1930 Ohio, Indiana and Illinois led in the number of Kentucky-born residents (figures 13a, b). Of all Kentucky-born persons living in Michigan in 1930, three-fourths had settled in the larger cities[34] and of those living in Ohio, one-half were in larger cities (of 100,000 or more population).

Negro Migrants. Negroes born in Kentucky and living in other states numbered 107,314 in 1930. At the same time only 40,899 negroes born in other states were living in Kentucky; about two-fifths of them were born in Tennessee, one-fifth in Alabama, and one-twelfth in Georgia. The negro migrants who were natives of Kentucky moved chiefly to states on its northern border, one-fourth to Ohio, one-fourth to Indiana, and one-sixth to Illinois. Altho the contribution to other states had by 1930 accumulated to more than two and one-half times the return migration, it is significant that the net amount of negro migration during the decade changed in direction. During this decade Kentucky gained a net of 2,017 whereas during the previous decade it lost a net of 5,554 to other states. Approximately 5,000 more Kentucky-born negroes were living in other states in 1930 than in 1920; but approximately 7,000 more negroes from other states were living in Kentucky. Thus, while the migration across state lines increased in both directions, the net amount per decade changed from an outward excess before 1920 to an inward excess after 1920. The negro birthrate had so

33 C. J. Galpin and T. B. Manny, *Interstate Migrations Among the Native White Population as Indicated by Differences Between State of Birth and State of Residence*, pages 68 to 69. Washington: U. S. D. A., Bureau of Agricultural Economics, 1934.

34 Ibid.

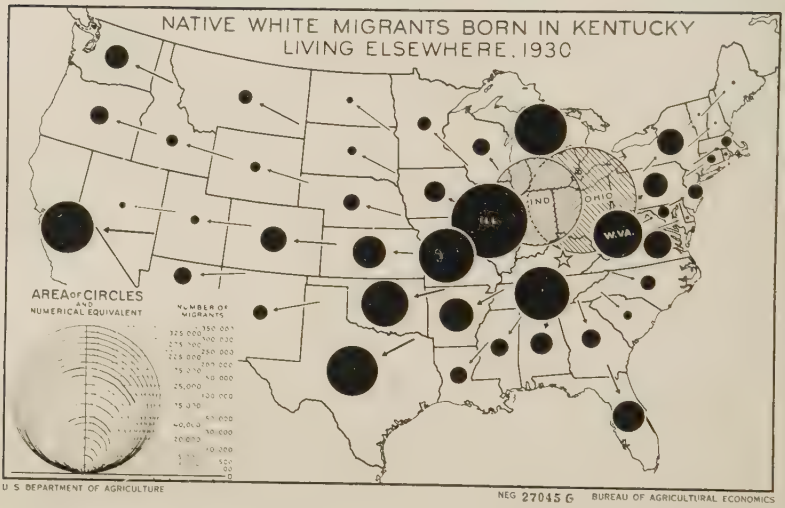

FIGURE 13. a. Native white migrants born in Kentucky living elsewhere, 1930.

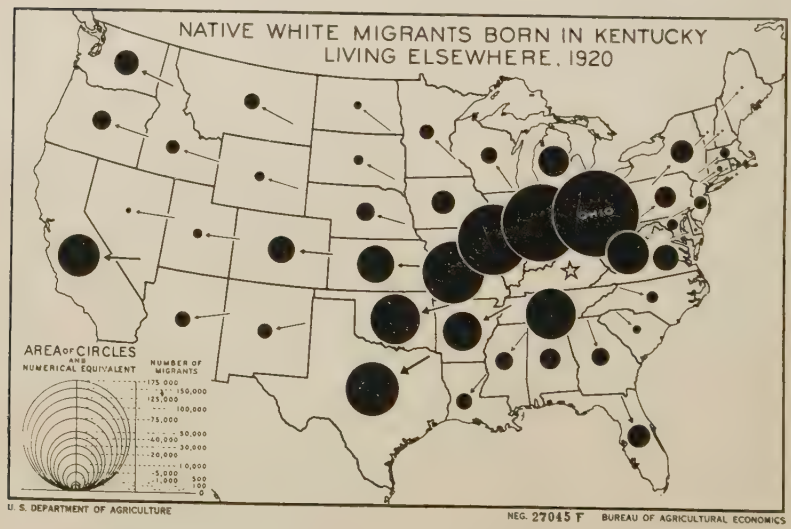

FIGURE 13. b. Native white migrants born in Kentucky living elsewhere, 1920.

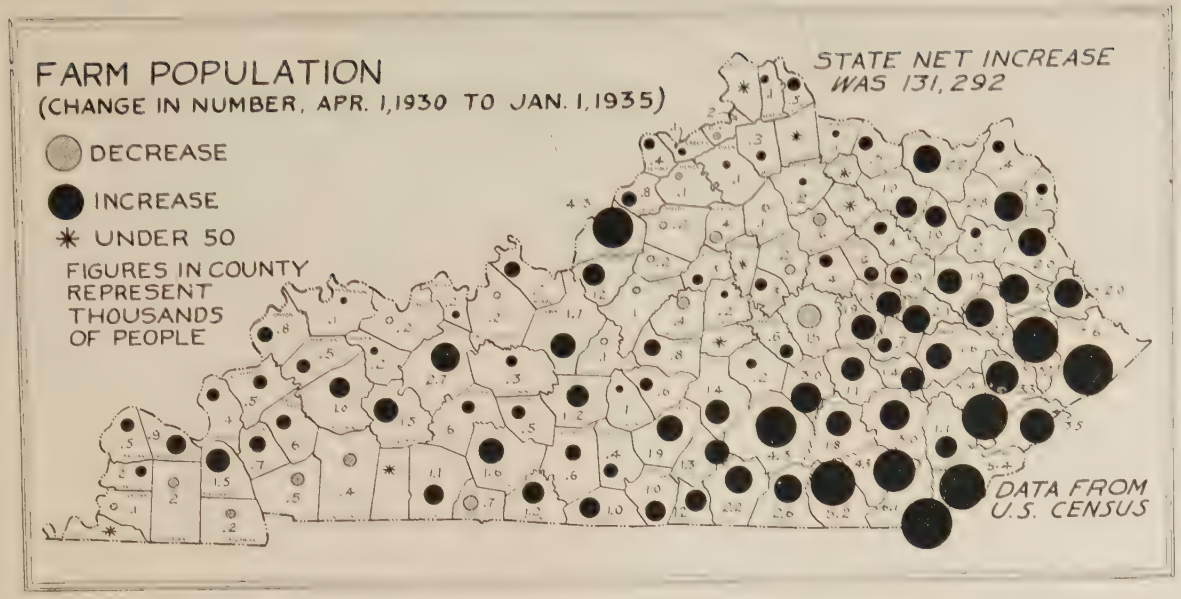
FARM POPULATION
(CHANGE IN NUMBER, APR. 1, 1930 TO JAN. 1, 1935)
DECREASE
INCREASE
UNDER 50
FIGURES IN COUNTY REPRESENT THOUSANDS OF PEOPLE
STATE NET INCREASE WAS 131,292
DATA FROM U.S. CENSUS

FIGURE 14. Farm population: change in number, April 1, 1930 to January 1, 1935

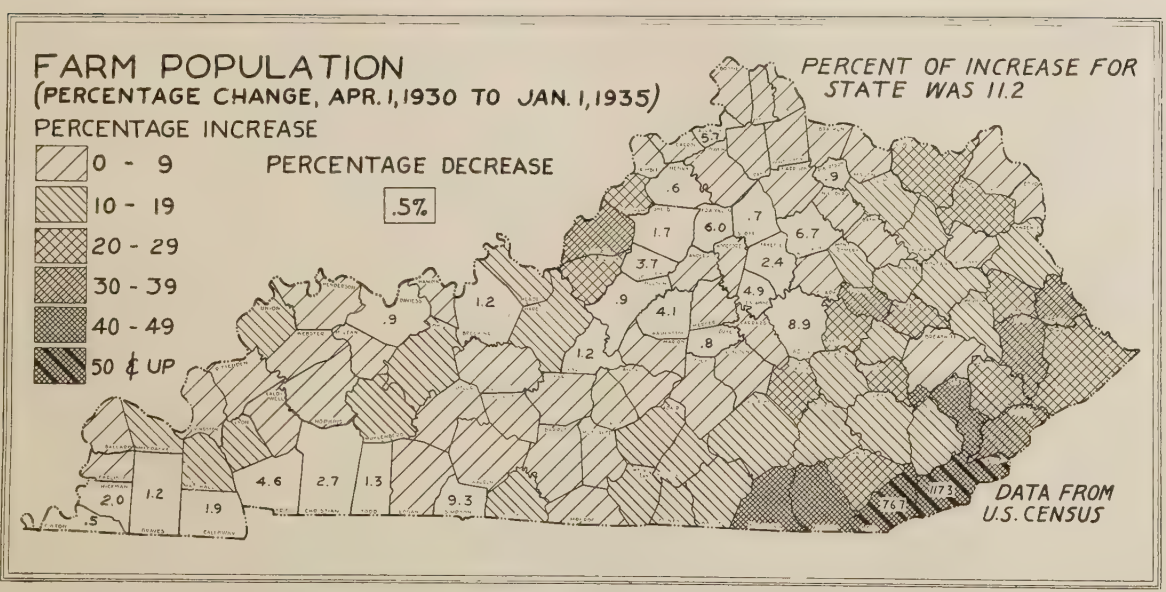

FIGURE 15. Farm population: percentage change, April 1, 1930 to January 1, 1935.

declined by 1920 that even this change in net migration was insufficient to prevent a decrease in the total number of negroes in Kentucky between 1920 and 1930[35].

FARM POPULATION: CHANGE IN NUMBER, 1930 TO 1935

Data for computing separately the rural-farm and rural nonfarm net migration from 1920 to 1930 are not available by counties. Furthermore, data for population trends after 1930 are available only for rural-farm population as enumerated in the 1935 Census of Agriculture.

There were 131,292 more farm persons enumerated in Kentucky in 1935 than in 1930 (figures 14 and 15). During this 5-year period the farm population in eight counties showed no significant change; that is, it had a net change of less than 50 persons. In 18 counties a decrease of more than 50 persons was recorded. Madison County led with a decline of 1,500 in the farm population. In all the other 94 counties the farm population of 1935 significantly exceeded that of 1930. The development of part-time and subsistence farms in all the Eastern Kentucky counties, and especially in the coal producing counties, in the Louisville suburbs of Jefferson county, and in the Western coal field is a factor that brought about the tremendous increase in farms. This development was a response to the declining industrial employment of the 5-year period. For the state as a whole, the farm population increased 11.2 percent from 1930 to 1935.

In each of five Southeastern coal field counties the farm population increase exceeded 40 percent (figure 15). The Harlan County farm population more than doubled in the five-year period. In these Eastern Kentucky counties, the high birthrates were accompanied by large migrations from the farm prior to 1930. This led to numerous returns to abandoned farms after 1930 and to the retention on farms of rural youth who did not succeed in finding urban employment.

SUMMARY

The central purpose of this study is to measure natural increase and migration, the two component factors of growth or decline, which together account for all changes in the size of any population.

35 The Federal Census of 1930 reported a decrease in Kentucky's negro population of 4.2 percent during the decade.

During the decade from 1920 to 1930, Kentucky population had high rates of natural growth, the index of natural increase for 1930 being 100 or more in all but five of the 120 counties. These five counties include the major areas of urban concentration in Kentucky.

In contrast to the areas of urban influence stands the rural territory of Eastern Kentucky, where seven counties have indexes above 225. The population in these seven counties would double in size by natural increase within 24 to 33 years if no migration were to occur.

In every county of Kentucky, the rural-farm population showed natural increase in 1930. However, proximity to large cities depressed the rate among farm people.

The negro population of Kentucky is barely self-maintaining. This is explained partly by the fact that 51.6 percent of Kentucky's negro population is urban, and only 21.2 percent is rural-farm; whereas, only 30.6 percent of Kentucky's white population is urban and 47.2 percent is in the rural-farm group. The index of natural increase for the state's negro population is only 102, in contrast to the index of 146 for the state's white population. The negro index is consistently lower than the white in all groups — rural-farm, rural-nonfarm and urban. The state index of 102 is so nearly at the maintenance level that it failed to offset emigration and resulted in a decline of negro population during the two decades from 1910 to 1930. The trend of negro births has been downward, indicating a natural decrease since 1930.

The net migration from the rural population of Kentucky counties was measured by comparing 5- and 10-year age groups in the 1920 population with age groups 10 years older in the 1930 population.

Except in the major coal-producing counties of the state the amount of rural net migration between 1920 and 1930 was related directly to the rural index of natural increase. Because the counties having the highest index of natural increase and the heaviest emigration also have the smallest economic resources, these counties are handicaped in the provision of adequate health, educational and cultural facilities for that part of their population which will later migrate to cities and wealthier rural areas.

APPENDIX

DEFINITIONS

Urban population. Population residing in cities and other incorporated places having 2,500 or more inhabitants, the remainder being classified as rural.

Rural population. The population living outside the corporation limits of urban places. It includes the rural-farm and the rural-nonfarm population.

Rural-farm population. All persons living on farms in rural territory, without regard to occupation. It excludes those living on farms in the urban territory. The urban-farm population of Kentucky in 1930 included 2,292 persons. They are a part of the urban population.

Rural-nonfarm population. Persons living in the open country and not on farms; persons in hamlets, unincorporated towns of less than 2,500 inhabitants; and persons living in suburban areas, outside the corporation lines of cities.

Natural increase. Growth in population resulting from the occurrence of more births than deaths (or decrease resulting from more deaths than births). This is distinguished from growth due to migration.

Index of natural increase. As used in this study it is 100 times the number of children under 5 years per 1,000 women 15 to 44 years, divided by the number required to maintain the population at its present size, assuming no migration out of or into the area. This is similar to the reproduction index as defined by Lorimer and Osborn*. A reproduction index, however, may be one of several possible ratios. The index of natural increase used in this study is a particular reproduction index for which the number of women aged 15 to 44 years is used as a base, rather than the number of women aged 20 to 44 years.

Arithmetic rate of increase. This method assumes an annual increment of population, recurring in the same amount during each

* *Dynamics of Population*, page 399. The Macmillan Co., 1934. "The ratio of the number of births or number of children found in any group under specified conditions to the corresponding replacement ratio gives a reproduction index, or *estimated rate of reproduction per generation.* Thus a reproduction index of 1.25 indicates an expected natural increase of 25 percent per generation; a reproduction index of .75 indicates an expected natural decrease of 25 percent (or a natural "increase" of *minus* 25 percent) per generation."

year in a time series. Thus, the increase in one year, multiplied by ten, gives the increase in ten years.

Geometric rate of increase. This method assumes a compounded annual increase, with a new base each year including the increment during the preceding year. Actually the increase is constant, because there is a continuous increase in the number of women of child bearing age. See the formula in column (h), table 2, page 272, in the appendix.

Isometric map. A map whose area is separated into belts or continuous strips showing uniformly graded intervals. Local political boundaries are either not indicated or are ignored. In method of graphic presentation, this type is similar to a topographic map.

Life table. A table of figures used by insurance companies and students of population to estimate the proportion of a given population that will be living after the lapse of a period of years.

Net migration. The difference between the number of persons who moved out of a given area and the number who moved into the same area during the specified time. Thus a heavy outward migration might be cancelled by an equally heavy inward migration. In such a case there is no net migration.

THE METHOD OF MEASURING NATURAL INCREASE: 1920 TO 1930

Altho birth and death rates have been widely used to measure the fertility of population, they have three disadvantages when applied to areas and groups within a state. Births are reported by place of occurrence rather than by place of residence of the mother[1]. This method credits to cities all the hospital births of non-resident mothers, hence it over reports urban births. Similarly, because hospital deaths are credited to cities, urban death rates are reported too high and rural death rates too low. These errors tend to compensate each other when official reports of both births and deaths are used to calculate the rate at which the population is gaining by natural increase. However, an unknown error remains.

A second disadvantage of the birth and death rates is that they are available separately only for those individual cities with 10,000 or more population. Cities with fewer than 10,000 people are grouped with rural areas for which reports are published only by

1 Beginning with its report for 1937, the State Board of Health of Kentucky, accepting a policy now being adopted in all the states, is reporting births and deaths by place of residence. This will eliminate the first difficulty mentioned here.

counties. Furthermore, it is impossible to compare rural-farm with rural-nonfarm groups.

A third disadvantage is that births[2] and deaths, especially infant deaths, are not all reported. Altho the number of children under 5 years of age is also under enumerated in the decennial Census, the extent of this error can be estimated and adjustments have been made for it in this study. The reported number of white children (1930) under 5 years old has been increased by five percent and the number of negro children under 5 years of age has been increased by 15 percent[3].

The number of children under 5 years of age per thousand females of child-bearing age is a measure of population increase that avoids the three disadvantages just enumerated. The age period of 20 to 44 years for women of child-bearing age has been designated by Lorimer and Osborn as desirable for use in calculating a measure of effective fertility[4]. These authors state that in the United States in 1928, about 4 percent of the mothers aged 15 to 44 years were in the 5-year group of 15 to 19 years, and that exclusion of the women 15 to 19 years would eliminate "the influence of variations in the number of females at ages when comparatively few are mothers of small children." However, early marriage is relatively more frequent in Kentucky than in the United States as a whole. Of the mothers to whom births occurred during 1929 in Kentucky, 15.5 percent were aged 15 to 19 years, 69.5 percent were aged 20 to 34 years, 15 percent were aged 35 to 44 years. Less than one percent of the mothers were younger than 15 or older than 44. Therefore, in this study of Kentucky population, the age period 15 to 44 years, has been taken to represent most adequately the child-bearing period, and it has been used in calculating the ratio of children under 5 years of age per thousand females of child-bearing age.

Using life tables for the white population[5] of Kentucky, prepared by the Metropolitan Life Insurance Company, the Scripps Foundation for Population Research calculated that, for 1930 con-

2 See Whelpton, P. K., The Completeness of Birth Registration in The United States, *Journal of the American Statistical Association*, June, 1934, pages 125 to 136.

3 For a published statement of these adjustments for under enumeration in the 1930 Census, see Thompson, W. S., and Whelpton, P. K., *Population Trends in the United States*, page 263, New York: McGraw-Hill, 1933.

4 Lorimer, F., and Osborn, F., *Dynamics of Population*, page 354, New York: The Macmillan Co., 1934.

5 It would be slightly more accurate to use negro life tables for the negro population of Kentucky, if such tables were available.

ditions in Kentucky[6], 370 children under 5 years in the rural population and 385 children under 5 years in the urban population, per 1,000 women 15 to 44 years of age, are needed to replace the deaths.

Because the death rates vary considerably from state to state and between urban and rural population, it would be necessary to use a different base in each instance when constructing a national index of natural increase. But within a single state the death rates and age composition are sufficiently uniform to use one replacement ratio for the rural population and one replacement ratio for the urban population[7].

The "index of natural increase" as used in this study is therefore defined as 100 times the number of children under 5 years per 1,000 women 15 to 44 years, divided by the number required to maintain the population at its present size, assuming no migration out of or into the area. An index of 100 for a rural population means that there are 370 children under 5 years of age per 1,000 females 15 to 44 years of age and that these are just sufficient to replace the persons removed from the population by death. Thus, a county whose index of natural increase is 150 is expected to have 50 percent more population at the end of 28 years (the approximate length of one generation), if no people move into or out of the county during this period or if they do move into and out of the county, the counter movements are equal, so that the size and sex ratio of each 5- or 10-year age group remains unchanged by migration.

THE METHOD OF STUDYING TRENDS IN NATURAL INCREASE: 1920 TO 1930

The number of children under 5, and the number of women 15 to 44 were reported by counties, for 1930, but not for 1920. The earlier census reported children under 7 and women 18 to 44 years of age. For the state of Kentucky in 1920 the ratio in terms of children under 5 and women 15 to 44 was 61.8 percent of the ratio in terms of children under 7 and women 18 to 44. This figure (.618) was used therefore as a conversion factor for 1920 ratios by counties. For the 1920 to 1930 comparison, the number of children reported was used without correction for under enumeration. I·

6 Unpublished data.

7 It would be more accurate to use a replacement ratio for each cultural area, but this at present is impossible because death rates and mortality tables are not available on an area basis.

is assumed that the under counting in each census was approximately the same.

THE METHOD OF STUDYING NET MIGRATION: 1920 TO 1930

The estimates of net migration to and from counties of Kentucky were obtained from Dr. C. W. Thornthwaite, who supervised the calculation for the "Study of Population Redistribution." The method used was that of subtracting natural increase from the population change (1920 to 1930), the remainder being net migration.

Net migration from the rural population of Kentucky counties was estimated by applying mortality table survival rates to the 1920 population by age groups, thus estimating the age groups to be expected in 1930 and attributing the difference between the expected and the actual amounts to migration. The unpublished calculations thus worked out were made available to the Kentucky Agricultural Experiment Station by Dr. C. E. Lively who supervised the Works Progress Administration research project under which they were made. The method when worked backward from 1930 is described thus:

> "To obtain the migration figure as a percent of the 1920 rural population, we took the 1930 rural population 10 years of age and over and applied to that a survival factor by age groups. This gave us a calculated 1920 population. The difference between the actual 1920 population and this calculated 1920 population was the potential migrants. We applied to this figure (potential migrants) a composite survival factor which gave us our surviving migrants. The difference between the potential and the surviving migrants was the migrant deaths. We assumed that half the migrants died before leaving the area and half after leaving the area, so we added this half to our surviving migrants. This gave us our net migration for each county. We then divided it by the 1920 rural population which gave us the percent of net migration into or out of the rural population of Kentucky counties."[8]

8 Letter to the author from C. E. Lively.

For the 76 Kentucky counties that are entirely rural, the migration percentage estimates as calculated by the natural increase method (Thornthwaite) and the survival rate method (Lively) can be compared. Three of these counties had net migration into the county (greater than zero). The table below compares the percentage estimates by the two methods for the 73 rural counties that had net migration out of the county (zero or less percentage).

Number of points difference in migration percentage estimates by the two methods	All counties	Number of counties showing larger estimates by the	
		Natural increase method	Survival rate method
0 to 1.9	48	17	31
2 to 3.9	16	5	11
4 or more	9	3	6
Total	73	25	48

Adjustments in Lively's calculation of rural net migration were made for five counties in which some population counted as rural in 1920 crossed the 2,500 mark by 1930, and for one in which 1920 urban population decreased to rural status by 1930 (Hickman in Fulton County).

Counties in which urban-rural shifts in classification occurred, 1920-1930	Migration percentage calculations by Lively	Corrected for urban-rural changes in classification
Calloway	−37.4	−26.5
Campbell	−10.1	+13.9
Fulton	+ 6.7	−15.8
Harlan	+40.8	+40.9
Kenton	+36.1	+47.6
Pike	−14.6	− 9.2

Adjustments were made also for eight counties in which rural territory was annexed to a city during the decade. In three such instances the 1920 population in the annexed area was so uncertain, calculations were made merely of the amount of decline between 1920 and 1930 in the rural part of the magisterial district that was involved. From this an estimate which was midway between the adjusted and unadjusted percentage was accepted as a corrected net migration figure.

Counties in which urban areas annexed rural areas	Percent of net migration (Lively's calculation)	Correction in rural population 1920	Percent net migration adjusted	Estimate of correct net migration
Barren	–23.2	– 756	–20.8	—
Boyd	–28.5	–2724	– 5.8	—
Daviess	–24.8	–2385	–14.8	–19.8
Fayette	+49.1	–2101	+76.0	+62.6
Harrison	–21.9	– 301	–20.1	–21.0
Jefferson	– 6.1	–7177	+10.5	—
Letcher	– 2.7	–2146	+ 8.2	—
Whitley	–29.1	–1283	–35.8	—

METHOD OF PREPARING ISOMETRIC MAPS

Figures 6 and 12 are isometric maps[9]. A natural-increase or net-migration figure for a county was inserted on the map at the county's geographic center. Points to be used in locating isometers were marked at interpolated intervals between county averages, on the assumption of uniform gradation. This method is at least as accurate as the one which assumes that an average for a county or other political unit is uniformly applicable to its whole area. It is evident that political boundaries of counties do not arbitrarily delimit areas of difference for cultural or other social data.

ANALYSIS OF POPULATION DATA BY TYPE-OF-FARMING AREAS

All the data used in this study were analyzed by grouping the counties according to type-of-farming areas and subareas. It was found, however, that the differences among counties within subareas were fully as significant as the differences among these subareas. Type-of-farming areas were not completely homogeneous with respect to rates of natural increase or rates of migration.

The grouping of counties into type-of-farming areas and subareas corresponds in general to the classification reported in the Kentucky Type-of-Farming study[10]. It differs from that classification only in the case of counties with portions lying in different areas. The data for this study were not available for units smaller than counties, and it was necessary to consider that all parts of a county lay in the same type-of-farming area.

9 cf. Mowrer, Ernest W., "The Isometric Map as a Technique of Social Research," American Journal of Sociology, Vol. XLIV, pages 86 to 96. July, 1938.

10 See Ky. Agric. Exp. Sta. Bul. 357, "Types of Farming in Kentucky."

AREA 1. (Counties of this area and its two subareas are listed in table 2).

AREA 2. Subarea 2a: Clinton, Lewis, Menifee, Powell, Rowan, Wayne.
Subarea 2b: Green, Taylor.
Subarea 2c: Adair, Allen, Casey, Metcalfe, Monroe.
Subarea 2d: Breckenridge, Hardin, Larue, Meade.
Miscellaneous: Bullitt, Cumberland, Pulaski, Russell.

AREA 3. Subarea 3a: Henry, Mason, Shelby, Trimble.
Subarea 3b: Owen.
Subarea 3c: Bourbon, Fayette, Jessamine, Woodford.
Miscellaneous: Anderson, Bath, Boone, Boyle, Bracken, Carroll, Clark, Fleming, Franklin, Gallatin, Garrard, Grant, Harrison, Lincoln, Madison, Marion, Mercer, Montgomery, Nelson, Nicholas, Pendleton, Robertson, Scott, Spencer, Washington.

AREA 4. Subarea 4a: Campbell, Kenton.
Subarea 4b: Jefferson.

AREA 5. Subarea 5a: Simpson, Warren.
Subarea 5b: Christian, Logan, Todd.
Subarea 5c: Caldwell, Lyon, Trigg.

AREA 6. Butler, Edmonson, Hancock, Muhlenberg, Ohio.

AREA 7. Subarea 7a: Daviess, Henderson, McLean.
Subarea 7b: Union.

AREA 8. Ballard, Calloway, Carlisle, Fulton, Graves, Hickman, McCracken, Marshall.

STATE, Miscellaneous Counties (partly in two or more areas): Barren, Crittenden, Estill, Grayson, Hart, Hopkins, Livingston, Oldham, Rockcastle, Webster.

Table 1. Index of natural increase and percentage distributions of population in Kentucky in 1930, by race and by class of residence.

Class of residence	Index of natural increase			Percentage distribution of population (add percentages vertically)			Percentage distribution of population (add percentages horizontally)		
	Total	White	Negro	Total	White	Negro	Total	White	Negro
Total population of Kentucky	142	146	102	100	100	100	100	91 3	8.7
Urban popu'ation	89	93	73	30.6	28.6	51.6	100	85.4	14.6
Cities of:									
100,000 and over	83	87	66	11 8	10.9	20.9	100	84.6	15.4
10,000 to 100,000	89	92	72	11.2	10.6	17.4	100	86.6	13.4
2,500 to 10,000	101	104	85	7 6	7.1	13.3	100	84.9	15.1
Rural population	172	174	143	69.4	71.4	48.4	100	94.0	6.0
Rural-farm	175	175	166	44.9	47.2	21.2	100	95.9	4.1
Rural-nonfarm	167	171	127	24 5	24.2	27.2	100	90.4	9.6

Table 2. Estimated number of years (from 1930) in which the population double if no migration were to occur, 27 Eastern Kentucky Mountain Counties const Type-of-farming Area 1.

Name of county	Population 1930 census	Annual average for 5-year period, 1929 to 1933			Annual rate of increase (e/b)	Number years ulation to doub	
		Deaths	Births	Excess births (d-c)		Arithmetic rate of increase (b/e)	Ge r inc lo log
(a)	(b)	(c)	(d)	(e)	(f)	(g)	
Area 1	658568	5261	18047	12786	.0194	52	
Subarea 1a	394138	2998	11133	8135	.0206	48	
Bell	38747	360	838	478	.0123	81	
Breathitt	21143	136	657	522	.0247	40	
Clay	18256	95	550	455	.0246	41	
Floyd	41942	235	1137	902	.0215	46	
Harlan	64557	576	1563	987	.0153	65	
Knott	15230	72	476	405	.0266	38	
Knox	26266	260	775	515	.0196	51	
Leslie	10765	80	395	315	.0293	34	
Letcher	35702	210	1008	799	.0224	45	
Martin	8584	68	281	213	.0250	40	
Owsley	7223	41	199	158	.0220	46	
Perry	42186	302	1307	1004	.0240	42	
Pike	63267	564	1946	1382	.0220	46	
Subarea 1b	264430	2263	6914	4651	.0176	57	
Boyd	43849	492	968	476	.0108	92	
Carter	23839	199	624	425	.0178	56	
Elliott	7571	68	249	181	.0240	42	
Greenup	24554	230	594	364	.0148	67	
Jackson	10467	50	319	269	.0257	39	
Johnson	22968	227	642	415	.0181	55	
Laurel	21109	132	489	358	.0169	59	
Lee	9729	67	243	176	.0180	55	
Lawrence	16713	149	438	289	.0173	58	
McCreary	14627	80	326	246	.0168	59	
Magoffin	15719	89	436	348	.0221	45	
Morgan	15130	137	484	347	.0229	44	
Whitley	29730	303	851	548	.0184	54	
Wolfe	8425	40	249	209	.0248	40	

* See Whipple, George C., *Vital Statistics*, page 145. New York: John Wiley & Sons, Inc., 1923. formula, $\log Pn - \log Pc = n \log (1+r)$, Pc is the population at one census, Pn is the population after Pc, r is the annual rate of increase and n is the number of years. In using this formula to ca the number of years for the population to double, we assign the values: Pc=1 and Pn=2. The log of therefore, $n \log (1+r) = \log 2$, and $n = \frac{\log 2}{\log (1+r)}$. In this table r is given in column f.

Table 3. Estimated number of years (from 1930) in which the population of Kentucky and its Type-of-Farming Areas* would double if no migration were to occur.

Type-of-farming area	Population 1930 census (a)	Average annual excess of births over deaths 1929-1933 (b)	Annual rate of increase (b/a) (c)	Number years for population to double, using: Arithmetic rate of increase (a/b) (d)	Number years for population to double, using: Geometric rate of increase** log 2 / log (1+r) (e)
The State	**2,614,589**	**23,714**	**.009,069**	**110**	**77**
1. Mountains	658,568	12,786	.019,410	52	36
2. Eastern Pennyroyal and Knobs	277,102	4,302	.015,520	64	45
3. Bluegrass	490,673	3,036	.006,187	162	112
4. Urban-Influence Areas	522,275	1,487	.002,847	351	243
5. Pennyroyal Plain	149,532	655	.004,380	228	211
6. West Coal field	92,495	1,170	.012,640	79	55
7. Lower Ohio Valley	98,199	946	.009,633	104	70
8. Purchase Region	148,525	844	.005,682	176	122
Miscellaneous Counties (Partly in 2 or more areas)	177,220	2,086	.011,770	85	60

* See discussion of method, page 269. ** See footnote to table 2.

Table 4. Index of natural increase for Kentucky counties by race and by p residence, 1930.

County	Total	Race		Residence		
		White	Negro	Urban	Rural	Rural-Nonfarm
State	**142**	**146**	**102**	**89**	**172**	**167**
Adair	175	175	174		175	138
Allen	130	130	124		130	115
Anderson	133	132	151		133	124
Ballard	119	118	129		119	90
Barren	146	146	140	99	160	141
Bath	156	157	143		156	141
Bell	178	181	125	118	221	224
Boone	124	124	134		124	123
Bourbon	124	129	106	90	144	122
Boyd	140	141	117	125	213	228
Boyle	118	126	87	79	152	138
Bracken	131	131	122*		131	117
Breathitt	232	232	229*		232	181
Breckenridge	154	155	149		154	129
Bullitt	147	147	142		147	137
Butler	171	177	178*		171	138
Caldwell	111	112	105	72	138	152
Calloway	100	101	89	64	110	102
Campbell	95	95	63	88	133	131
Carlisle	135	135	121*		135	116
Carroll	134	134	141		134	109
Carter	202	202	166*		202	207
Casey	198	198	207*		198	170
Christian	103	99	110	69	125	92
Clark	120	126	89	86	165	201
Clay	228	229	213		228	210
Clinton	180	180	155*		180	170
Crittenden	139	139	144*		139	133
Cumberland	180	181	168		180	132
Daviess	127	130	95	101	161	158
Edmonson	197	199	75*		197	209
Elliott	212	212	*		212	180
Estill	190	191	74*	144	206	194
Fayette	89	90	84	71	130	131
Fleming	145	145	138		145	118
Floyd	228	231	133		228	232
Franklin	101	105	76	69	141	134
Fulton	114	112	124	66	132	107
Gallatin	161	158	227*		161	136
Garrard	168	169	165		168	118
Grant	129	130	88*		129	114
Graves	109	110	99	77	125	128
Grayson	170	169	203*		170	116
Green	152	149	195		152	136

Table 4. (Continued.) Index of natural increase for Kentucky counties by race and by of residence, 1930.

County	Total	Race		Residence			
		White	Negro	Urban	Rural	Rural-Nonfarm	Rural Farm
nup	196	196	144*		196	181	217
ock	152	153	126*		152	129	160
in	140	142	110	90	149	128	158
n	196	208	124	132	209	208	214
son	122	123	114	92	137	149	135
	150	148	164		150	117	158
erson	124	126	113	92	155	123	168
y	141	141	146		141	118	152
nan	125	125	122		125	105	132
ins	116	127	85	74	141	147	132
on	215	215	450*		215	174	220
son	87	91	68	83	121	118	129
mine	141	144	126	94	159	154	162
on	192	192	291*		192	190	194
on	98	100	76	93	127	120	142
t	248	249	215		248	248	248
	182	183	130	130	185	175	193
	146	146	149		146	118	155
el	191	191	161		191	166	200
ence	184	184	162*		184	148	194
	200	200	220*		200	183	209
	260	260	*		260	185	265
er	223	230	134	192	234	235	232
	198	198	93*		198	177	207
ln	168	173	130		168	136	183
gston	139	137	193		139	138	140
n	128	116	122	89	136	111	142
	136	135	142		136	108	150
acken	97	103	72	88	130	155	115
eary	224	224	225*		224	228	217
an	151	152	101*		151	133	162
son	143	144	134	82	167	138	175
ffin	210	210	304*		210	226	207
on	172	175	146	108	191	165	199
hall	120	120	135*		120	124	118
n	232	232	*		232	226	236
n	126	125	133	95	144	148	142
e	166	165	194		166	155	170
fee	205	205	249*		205	137	212
er	125	125	119	94	138	151	135
alfe	167	165	211		167	140	170
oe	170	170	177		170	138	175
gomery	138	145	107	91	169	163	171
an	199	199	275*		199	180	201
enberg	156	161	110	97	165	169	160
n	156	156	163		156	133	174

Table 4. (Concluded.) Index of natural increase for Kentucky counties by race place of residence, 1930.

County	Total	Race		Residence		
		White	Negro	Urban	Rural	Rural-Nonfarm
Nicholas	136	139	109		136	109
Ohio	151	152	136		151	152
Oldham	134	133	152		134	119
Owen	142	142	146		142	112
Owsley	207	207	147*		207	110
Pendleton	148	147	218*		148	133
Perry	224	229	152	143	244	246
Pike	226	227	141	104	233	236
Powell	198	195	323*		198	157
Pulaski	180	182	105	107	197	161
Robertson	137	138	108*		137	113
Rockcastle	207	207	163*		207	174
Rowan	203	203	186*		203	175
Russell	184	183	239		184	167
Scott	134	138	115	88	156	153
Shelby	123	123	123	80	138	105
Simpson	116	116	116	72	133	171
Spencer	171	167	226		171	163
Taylor	149	147	180		149	112
Todd	130	131	129		130	104
Trigg	151	146	173		151	118
Trimble	155	155	135*		155	118
Union	147	150	122	106	153	136
Warren	119	120	117	79	149	149
Washington	168	165	195		168	136
Wayne	189	194	102		189	162
Webster	118	125	84	102	124	116
Whitley	168	168	164	124	183	186
Wolfe	215	215	*		215	177
Woodford	146	156	104		146	109

* Index unreliable; less than 30 negro children under five years of age in the county.

ble 5. Index of natural increase for Kentucky Type-of-Farming areas and subareas*, e and place of residence, 1930.

-of-Farming Area	Total	Race		Residence			
		White	Negro	Urban	Rural	Rural-Nonfarm	Rural-farm
.....	142	146	102	89	172	167	175
1	203	205	136	132	215	214	217
rea 1a	214	219	135	143	225	223	228
rea 1b	185	186	147	125	200	193	203
2	170	171	156	101	173	144	181
rea 2a	195	195	142	-	195	169	204
rea 2b	150	148	190	-	150	120	159
rea 2c	168	168	174	-	168	134	174
rea 2d	149	149	137	90	152	130	161
aneous	177	178	143	107	184	152	192
3	130	133	111	79	150	132	157
ea 3a	131	131	131	90	142	127	149
ea 3b	142	142	146	-	142	112	151
ea 3c	104	108	91	74	141	129	153
aneous	140	142	123	82	153	134	160
4	90	93	68	86	123	120	133
ea 4a	97	98	73	90	129	125	139
ea 4b	87	91	68	83	121	118	129
5	120	120	120	74	137	115	145
ea 5a	119	119	117	78	144	149	143
ea 5b	116	116	116	71	130	99	142
ea 5c	131	129	143	72	143	124	150
6	162	164	118	97	165	163	167
7	132	135	108	98	155	138	166
ea 7a	129	132	105	98	156	139	164
ea 7b	147	150	122	106	153	136	176
8	108	110	92	83	124	116	126
Miscellaneous	147	151	108	95	157	141	165

e discussion of method, p. 269.

Table 6. Net migration, 1920-1930, for Kentucky counties, expressed a percent of 1920 population, total and rural.

County	Population: 1920		Net migration, 1920-30 as percent of 1920 population	
	Rural	Total	Rural[1]	Total[2]
State	**1,783,087**	**2,416,630**	**16.1**	**6.0**
Adair	17,289		—22.6	
Allen	16,761		—22.7	
Anderson	9,982		—24.5	
Ballard	12,045		—26.3	
Barren	22,797	25,356	—20.8	—13.4
Bath	11,996		—22.3	
Bell	23,039	33,988	—23.4	— 5.8
Boone	9,572		— 8.7	
Bourbon	12,108	18,418	—14.7	— 5.9
Boyd	10,369	29,281	— 5.8	+28.2
Boyle	9,899	14,998	—17.9	+ 0.8
Bracken	10,210		—15.8	
Breathitt	20,614		—25.2	
Breckenridge	19,652		—24.8	
Bullitt	9,328		—19.0	
Butler	15,197		—31.4	
Caldwell	10,286	13,975	—23.2	—10.5
Calloway	20,802		—26.5	—25.3
Campbell	12,498	61,868	+13.9	+12.2
Carlisle	8,231		—21.2	
Carroll	8,346		—13.5	
Carter	22,474		—19.0	
Casey	17,213		—24.7	
Christian	26,187	35,883	—17.4	— 5.3
Clark	9,568	17,901	—16.7	—10.2
Clay	19,795		—31.2	
Clinton	8,589		—17.4	
Crittenden	13,125		—21.2	
Cumberland	10,648		—23.7	
Daviess	23,309	40,733	—19.8	— 5.2
Edmonson	10,894		—18.5	
Elliott	8,887		—34.4	
Estill	12,864	15,569	—21.3	—20.3
Fayette	13,130	54,664	+62.6	+25.4
Fleming	15,614		—26.8	
Floyd	27,427		+ 7.4	
Franklin	9,552	19,357	—14.6	+ 3.3
Fulton	9,149	15,197	—15.8	— 7.2
Gallatin	4,664		—16.7	
Garrard	12,503		—22.8	
Grant	10,435		—14.8	
Graves	25,900	32,483	—23.2	—16.3
Grayson	19,927		—29.4	
Green	11,391		—16.9	
Greenup	20,062		— 6.1	
Hancock	6,945		—23.9	

Table 6. (Continued.) Net migration, 1920-1930, for Kentucky Counties, expressed in a percentage of 1920 population, total and rural.

County	Population: 1920		Net migration, 1920-30 as percent of 1920 population	
	Rural	Total	Rural[1]	Total[2]
Hardin	21,757	24,287	—26.5	—24.2
Harlan	28,899	31,546	+40.9	+65.5
Harrison	11,941	15,798	—21.0	—13.9
Hart	18,544		—26.5	
Henderson	15,440	27,609	—19.1	—14.7
Henry	13,411		—15.9	
Hickman	10,244		—25.1	
Hopkins	25,451	34,133	— 9.6	— 3.7
Jackson	11,687		—32.5	
Jefferson	44,301	286,369	+10.5	+18.5
Jessamine	9,419	12,205	—16.3	— 8.6
Johnson	19,622		—11.6	
Kenton	11,750	73,453	+47.6	+18.6
Knott	11,655		— 7.5	
Knox	22,983	24,172	—18.7	—15.9
Larue	10,004		—20.8	
Laurel	19,814		—17.3	
Lawrence	17,643		—24.3	
Lee	11,918		—38.3	
Leslie	10,097		—25.3	
Letcher	19,760	24,467	+ 8.2	+15.5
Lewis	15,829		—26.5	
Lincoln	16,481		—11.6	
Livingston	9,732		—22.8	
Logan	20,509	23,633	—20.6	—16.9
Lyon	8,795		—14.5	
McCracken	12,511	37,246	—11.9	+19.2
McCreary	11,676		—10.6	
McLean	12,502		—25.0	
Madison	20,662	26,284	—15.8	— 9.0
Magoffin	13,859		—16.6	
Marion	12,288	15,527	—20.5	—16.5
Marshall	15,215		—25.9	
Martin	7,654		—19.0	
Mason	11,653	17,760	— 7.6	+ 0.4
Meade	9,442		—27.8	
Menifee	5,779		—33.6	
Mercer	11,030	14,795	—17.6	—12.7
Metcalfe	10,075		—22.3	
Monroe	14,214		—25.9	
Montgomery	8,250	12,245	—26.6	—15.6
Morgan	16,518		—28.4	
Muhlenberg	30,245	33,353	—11.4	— 7.6
Nelson	16,137		—13.1	
Nicholas	9,894		—21.6	
Ohio	26,473		—22.2	
O'dham	7,689		—13.1	
Owen	12,554		—24.2	

Table 6. (Concluded.) Net migration, 1920-1930, for Kentucky Counties, expressed in a percentage of 1920 population, total and rural.

County	Population: 1920		Net migration, 1920-30 as percent of 1920 population	
	Rural	Total	Rural[1]	Total[2]
Owsley	7,820		—29.1	
Pendleton	11,719		—18.1	
Perry	21,694	26,042	+12.0	+19.6
Pike	49,477		— 9.2	— 1.6
Powell	6,745		—32.0	
Pulaski	29,338	34,010	—19.8	—14 5
Roberton	3,871		—22.9	
Rockcastle	15,406		—24.6	
Rowan	9,467		—12.5	
Russell	11,854		—21.0	
Scott	11,415	15,318	—21.6	—14.8
Shelby	14,772	18,532	—18.4	—11.0
Simpson	7,996	11,150	—10.7	— 3.6
Spencer	7,785		—29.6	
Taylor	12,236		—16.8	
Todd	15,694		—23.0	
Trigg	14,208		—25.2	
Trimble	6,011		—23.0	
Union	15,389	18,040	—20.6	—21.2
Warren	21,220	30,858	—13.6	— 2.5
Washington	14,773		—28.7	
Wayne	16,208		—23.6	
Webster	16,611	20,762	—16.8	—14.1
Whitley	25,532	27,749	—25 8	—16.8
Wolfe	8,783		—27.7	
Woodford	11,784		—18.1	

1 The data are corrected for changes in city boundaries and for transitions from rural to urban classification. Uncorrected data from C. E. Lively, ibid.

2 Percentages in the total column are shown for only those counties whose population was not entirely rural. The county data were obtained from C. W. Thornthwaite, ibid.